

28. (Withdrawn) A method of improving electron emission as claimed in claim 27 also comprising forming a focusing electrode proximate the extractor electrode.

29. (Withdrawn) A method of improving electron emission as claimed in claim 26 also comprising forming a tip-based geometry on the emitter electrode.

30. (Withdrawn) A method of improving electron emission as claimed in claim 25 also comprising modulating the applied field to control the induced electron emissions from the low electron affinity material.

31. (Withdrawn) A method of improving electron emission as claimed in claim 25 wherein the junction has a barrier height ranging from 0.1 eV to 2.0 eV.

#### **REMARKS**

Applicant expresses appreciation to the Examiner for consideration of the subject patent application and identification of allowable subject matter. This amendment is in response to the Office Action mailed April 28, 2004. Claims 1-14 were cancelled. Claims 15-31 were pending in this case.

By this Amendment, claim 15 has been amended. Claims 16-24 remain in the case unchanged. Claims 25-31 have been withdrawn.

#### **Election/Restriction Requirements:**

In response to the restriction requirement made in a telephone call to Trueman Denney on April 14, 2004, the Applicant provisionally elected, with traverse, claims 15-24 drawn to a semiconductor device. Applicant hereby affirms that election.

The Applicant respectfully traverses the restriction requirement for the following reasons. Examination of method claims 25-31 in the same application would not pose a serious burden under M.P.E.P. § 806.05(f) because the processes mentioned for making the invention are not materially different from the semiconductor device claims. They are both fundamentally directed to the same art. Additionally, examination of method claims 25-31 in the same application would not pose a serious burden under M.P.E.P. § 806.04(b) and M.P.E.P. § 806.04(h) because the inventions are obvious variants.

## Claim Rejections - 35 U.S.C. § 102

Claims 15 and 17-18 were rejected under 35 U.S.C. § 102(b) as being anticipated by Chalamala et al (US Patent 6,091,190).

A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single reference that qualifies as prior art under 35 U.S.C. § 102. *Verdegaal Brothers v. Union Oil Co. of California*, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987). The identical invention must be shown in as complete detail as is contained in the claim. *Richardson v. Suzuki Motor Co.*, 9 USPQ2d 1913, 1920 (Fed. Cir. 1989).

In order to most succinctly explain why the claims presented herein are allowable, Applicant will direct the following remarks primarily to independent claim 15, as amended, with the understanding that once an independent claim is allowable, all claims depending therefrom are allowable.

In claim 15, as amended, a Schottky diode is formed on the emitter electrode, comprising a Schottky metal layer formed on the emitter electrode and a semiconductor layer formed on the Schottky metal layer. As stated in the specification, page 6, beginning at line 16, this Schottky metal-semiconductor junction enhances the electron beam formation and transmission that originated at the emitter electrode.

As is well known, a Schottky junction creates an effect that lowers the potential barrier at the junction interface to effectively lower the work function. The current across the metal-semiconductor junction is enhanced by carrier diffusion, thermionic emission of carriers and quantum tunneling through the barrier. Thus, a Schottky junction creates an active interaction that lowers the barrier across the junction and reduces the effective work function.

In contrast, there is no interactive Schottky junction in the Chalamala patent. Rather, only a passivation layer 120 is formed over the emitter electrode 118 primarily for the purpose of protecting the electrode for oxidation. See column 3, lines 24-34 of the Chalamala patent. The passivation layer also has a work function lower than that of the emitter electrode. See column 3, lines 35-38. However, there is no interactive Schottky junction formed by a semi-conductor layer interacting with a metal layer that is formed on emitter electrode, as in the present invention.

The contrast between the present invention and the device in Chalamala is clearly shown by comparing Figure 6 of the present application to Figure 1 in Chalamala. In Figure 1 of Chalamala a single passivation layer 120 is formed on emitter electrode 118. In Figure 6 of the present application, a metal layer 114 is formed on an emitter electrode 112, and a semi-conductor layer 116 is formed on the metal layer 114 to form the Schottky junction with the metal layer 114.

The Examiner proposes that the emitter electrode 118 and the passivation layer 120 form a Schottky junction. Applicant respectfully submits that the electrode 118 and the passivation layer do not form a Schottky junction. The electrode emitter is formed as a metal structure primarily for the purpose of emitting electrons, rather than as a thin metal layer interacting with a semi-conductor, as in a Schottky device. This is confirmed by the description in the Chalamala patent which makes no mention of a Schottky device or junction. Rather Chalamala describes the emitter as an emitter and the passivation layer as a protective layer to prevent the emitter electrode from oxidizing.

In any event, it is clear that Chalamala does not disclose or imply the formation of a metal layer on the emitter electrode which, together with a semi-conductor layer, form a Schottky junction. Accordingly, claim 15, as amended, clearly distinguishes from Chalamala in both structure and in function. Claims 17 and 18 are dependent on claim 15. Since claim 15 as amended is considered to be allowable in view of this Amendment, dependent claims 17 and 18 are also allowable.

### **Claim Rejections - 35 U.S.C. § 103**

Claims 16,19-21 and 23-24 were rejected under 35 U.S.C. § 103 as being unpatentable over Chalamala as applied to claim 15 above and further in view of Christensen (US Patent 4,663,559).

The standard for establishing and maintaining a rejection under 35 U.S.C. § 103(a) is set forth in M.P.E.P. § 706.02(j), which provides:

To establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference

or combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosure. *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991).

It is respectfully submitted that a *prima facie* case of obviousness has not been established against any of claims 16, 19-21 and 23-24. First, for the reasons given above, amended independent claim 15 (and therefore dependent claims 16, 19-21 and 23-24) clearly distinguishes patentably over the Chalamala patent. In Chalamala, there is no interactive Schottky junction formed by a semi-conductor layer interacting with a metal layer that is formed on emitter electrode, as in the present invention. Neither does Chalamala imply or provide any indication of the formation of a metal layer on the emitter electrode that, together with a semi-conductor layer, forms a Schottky junction. Accordingly, claims 16, 19-21 and 23-24 are not obvious in view of the Chalamala patent.

Moreover, the Christensen patent discloses only an emission device that has a focusing electrode coupled to the emitter. Emitting microgun 40 comprises only a conductive base portion 40 having a cermet tip 42. See column 11, lines 50-54. Christensen does not disclose or imply the formation of a metal layer on the emitter electrode that, together with a semi-conductor layer, forms a Schottky junction. One of ordinary skill in the art would not be able to combine the teachings of Chalamala with Christensen to result in the Schottky junction structure described in the claims of the present invention.

According, Applicant respectfully submits that claims 16, 19-21 and 23-24 are allowable over the references cited, and urges the Examiner to withdraw the rejection under Section 103(a).

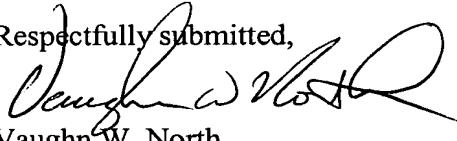
## CONCLUSION

In light of the above, Applicant respectfully submits that pending claims 15-24 are now in condition for allowance. Therefore, Applicant requests that the final rejection be withdrawn, and that the claims be allowed and passed to issue. If any impediment to the allowance of these claims remains after entry of this Amendment, the Examiner is strongly encouraged to call Vaughn North at (801) 566-6633 so that such matters may be resolved as expeditiously as possible.

The Commissioner is hereby authorized to charge any additional fee or to credit any overpayment in connection with this Amendment to Deposit Account No. 08-2025.

DATED this 2<sup>nd</sup> day of August, 2004.

Respectfully submitted,



Vaughn W. North

Registration No. 27,930

THORPE NORTH & WESTERN, LLP  
Customer No. 20,551  
P.O. Box 1219  
Sandy, Utah 84091-1219  
Telephone: (801) 566-6633